

## REMARKS

Claims 1-4 and 6-10 are pending in the application prior to entering this amendment.

Claims 1-4 and 6-10 are rejected.

Claims 1-3, and 7-9 are rejected under 35 U.S.C. 103(a).

Claims 1 and 10 are currently amended.

Claim 11 is new.

No new matter is added.

Claims 1-4 and 6-11 remain in the case for consideration.

Applicant requests reconsideration and allowance of the claims in light of the above amendments and following remarks

The applicant submits that the directions such as “downward”, “top”, and “side” should be determined based on the optical substrate (where the optical waveguide is formed) and the direction of information / pump signal propagating within the waveguide. Pump propagation axis and Signal propagation axis are formed on the surface of the optical substrate in thin film devices. The definition of “top” and “side” is then clear.

In addition, optical waveguides formed on optical substrate are usually of a thin film type – especially in the case of an adiabatically expanded waveguide, as illustrated in Delaveaus’s patent, for example.

Figure 4 of Delaveaux’s patent is a plane-view showing a waveguide for information signal  $\lambda_s$  and a second waveguide for the pump light respectively formed on an optical substrate. It will be easily understood that the pump light is guided by the pump waveguide 72 and then irradiated on a small edge-wise area of the side of the signal waveguide. On the contrary, in the applicant’s claimed invention, the pump light can be irradiated from the top of the substrate, without the need of complex geometry of a pump waveguide or a pump light coupling means (free-space propagation), covering a larger area than merely the edge of the side of the signal waveguide, as in Delaveaux.

As an analogy, the difference between Delaveaux and the claimed invention is like the difference between an electronic PCB circuit having electric signal amplifying power lines formed on the surface of the PCB (two-dimensional), versus a new type of PCB geometry

providing the power from the source out of the PCB plane which enables three-dimensional access of the power lines anywhere in the circuit.

In this manner, Delaveaux makes it clear that the pump waveguide and the signal waveguide are to be formed on the same optical substrate. This requires fabrication of two (signal, pump) waveguides, and two coupling means of input and pump beams into their respective waveguides. With two or multiples of signal waveguides, it becomes physically impossible to excite rare earth ions in these multiples, due to the perturbation and absorption experienced by signals and pump light made from the waveguide overlapping regions.

In contrast, the claimed invention is directed to a pump source that is located above or below the optical substrate on which the waveguide for the signal beam is formed, and the pump beam shines directly onto the waveguide without a waveguide guiding the pump beam. This eliminates both the pump waveguide formation and pump beam coupling steps, and presents a significant improvement, while providing technical advances that enable methods to excite all the rare earth ions in the signal waveguide. Further, as the association of pump light to signal waveguide is directly face-to-face, there is no added technical difficulty or limitation to excite rare-earth doped waveguide arrays – or waveguide structure having even more complex geometry, as, for example AWG (arrayed waveguide grating).

Also, with Delaveaux's invention, it is impossible to excite rare-earth ions doped in arrays or AWG, and to amplify signal waves in the lightwave circuit.

### ***Claim Rejections – 35 USC § 103***

Claims 1-3, and 7-9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Delaveaux (US 6,043,929) in view of Abdelkader (US 5,555,127).

The applicant amends claim 1 to recite, among other limitations, a light source disposed above the gain medium structure for pumping the gain medium structure by means of pump light transmitted downward from the light source external to a waveguide on the substrate. Support for this amendment can be found, for example, in the Specification, page 5, lines 10-15.

The Examiner cites Delaveaux in combination with Abdelkader for teaching claim 1. But neither reference teaches or makes obvious pump light transmitted downward from the light source *external* to a waveguide on the substrate. For example, Delaveaux's FIG. 4 shows second waveguide 72 for transmitting the pump signal, wherein the second waveguide 72 is part of the

optical substrate 64 (col. 4, lines 15-16). But claim 1 requires pump light transmitted *external* to a waveguide on the substrate. Thus Delaveaux teaches away from this limitation of the claim.

And Abdelkader also teaches away from this limitation of claim 1, for example, in the Abstract that describes the amplifier fabricated on a single crystal substrate.

Claims 2, 3, and 7-9 depend from claim 1 and inherently include all of the limitations of the base claim. As discussed above, the prior art does not teach the limitations of the base claim much less the further limitations of the dependent claims. Therefore, claims 2, 3, and 7-9 are allowable for their dependency and their own merits. Allowance of these claims is requested.

Claims 4, 6, and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Delaveaux (US 6,043,929) in view of Abdelkader (US 5,555,127), and further in view of Garito.

Claim 10 has been amended to include limitation similar to those added to amended claim 1. And so, claim 10 is also allowable in view of the cited references. And Garito fails to make up for the remaining references' shortcomings.

Claims 4 and 6 depend from claim 1 and inherently include all of the limitations of the base claim. As discussed above, the prior art does not teach the limitations of the base claim much less the further limitations of the dependent claims. Therefore, claims 4 and 6 are allowable for their dependency and their own merits. Allowance of these claims is requested.

### ***New Claims***

Claim 11 finds support from, for example, the Specification, FIG. 2 and page 5, line 11.

The references fail to show, teach, or make obvious the limitation of claim 11 reciting that the larger area of the gain medium structure is horizontal and the pump light is transmitted vertically downward from the light source. For example, Delaveaux, in FIG. 4, shows the larger area of multimode region 40 disposed horizontally, while transmitted pump light  $\lambda_p$  follows the waveguide 72 that is also horizontal. Claim 11 requires pump light to transmit vertically onto a horizontal larger area.

For the foregoing reasons, reconsideration and allowance of claims 1-4 and 6-11 of the application as amended is requested. The Examiner is encouraged to telephone the undersigned at (503) 222-3613 if it appears that an interview would be helpful in advancing the case.

Respectfully submitted,

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A handwritten signature in black ink, appearing to read 'Hosoon Lee', written over a horizontal line.

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